# IMPROVING CONSTRUCTION MATERIALS MANAGEMENT PRACTICES IN CONSTRUCTION SITES

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**A THESIS SUBMITTED IN PARTIAL**
**FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN CONSTRUCTION TECHNOLOGY MANAGEMENT**

**FACULTY OF TECHNOLOGY MANAGEMENT AND BUSINESS**
**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**JANUARY 2017**

## DEDICATION

This thesis is sincerely dedicated to my beloved parents Hassan Ahmed, and Naima Ali Hashim, and my lovely wife Huddo Haji Hussein, and our kids (Heysam, Hiyaam, and Sumaya) and my brothers and sisters.

## ACKNOWLEDGEMENT

In the name of Allah, Most Gracious, Most Merciful.

Alhamdulillah, with His Blessings I have finally completed this thesis.

The master project journey commenced at Johor, Universiti Tun Hussein Onn Malaysia (UTHM) University under the supervision of Associate Professor Dr. Narimah Binti Kasim. In September 2015, I started my Master project to the Department of Construction Management at Universiti Tun Hussein Onn Malaysia (UTHM), where Associate Professor Dr. Narimah Binti Kasim kindly agreed to be my principal supervisor. Associate Professor Dr. Narimah Binti Kasim has provided me with constant support and her advice and guidance enabled me to complete this thesis with confidence. I could not have had a better supervisor.

I would like to express my sincere and heartfelt thanks to those who mean most to me; my lovely wife, Huddo Haji Hussein, our lovely kids, Heysam, Hiyaam, and Sumaya my mum, Naima Ali Hashim, and family members for their sacrifices, prayers and patience to make this endeavour successful.

I would like to thank my friend Ahmed Elmi, who had read and critically commented on my drafted work, as well as to all my friends and colleagues at Department of Construction Management, Faculty Technology Management and Business, UTHM.

I would like to gratefully acknowledge my deep appreciation my father Hassan Ahmed and Ahmed Jarane for the financial support and opportunity to complete my study.

Finally, I would like to thank all of the respondents of this research, who gave freely of their insights and their valuable time in helping me throughout my study. My apologies to those people unfairly omitted in this acknowledgement.

# ABSTRACT

Construction Materials Management is a vital function for improving productivity in construction projects. Poor materials management can often affect the overall construction time, quality and budget. Currently, the construction material management practice in Somalia is believed to be poorly performed. Lack of standardized construction materials management system is one of the key issues facing by the building industry in Mogadishu-Somalia. The aim of this study was to investigate the current practices of material management at construction sites in Mogadishu-Somalia. A questionnaire survey study design was used to explore construction materials management practices. Fifty questionnaires were distributed to project managers, project engineers, site engineers, engineer, and foreman, and they were received and analysed. The following data analysis techniques were used: descriptive statistics were conducted to report sample characteristics, reliability and validity analyses were performed to confirm robustness of the instrument, graphical presentation such as bar charts were developed, and finally Average Mean Index Scale were constructed. The study results reveals that, 46.7% of respondent's organization obtain materials for sites without site requisition by site engineer provisions, while 28.9% of respondent's organization procure materials for sites with site requisition by project manager provisions and 13.3% of respondent's organization procure materials for site by engineer. The results indicated that currently there is no standardized and computerized construction materials management system applied in Somalia. The researcher concluded that all contracting companies are interested in using some techniques of managing construction materials such as creating and updating database for materials categories from local and international suppliers. Finally, researcher recommends to use computerized construction materials management systems to reduce effort and time, and to achieve more accurate results.

## ABSTRAK

Pengurusan Bahan Binaan ialah fungsi penting untuk meningkatkan produktiviti dalam projek-projek pembinaan. Pengurusan bahan yang buruk sering boleh menjejaskan keseluruhan masa pembinaan, kualiti dan bajet. Pada masa ini, amalan pengurusan bahan pembinaan di Somalia dipercayai dilakukan dengan buruk. Kurangnya pengurusan bahan binaan yang seragam adalah salah satu isu utama yang dihadapi oleh industri pembinaan di Mogadishu-Somalia. Tujuan kajian ini adalah untuk mengkaji amalan semasa pengurusan bahan di tapak pembinaan Mogadishu-Somalia. Satu reka bentuk kajian tinjauan keratan rentas digunakan untuk meneroka amalan pengurusan bahan binaan. Lima puluh soal selidik telah diedarkan kepada pengurus projek, jurutera projek, jurutera tapak, jurutera, dan mandur, dan semuanya telah diterima dan dianalisis. Teknik-teknik analisis data berikut telah digunakan: statistik deskriptif telah dijalankan untuk melaporkan ciri-ciri sampel, kebolehpercayaan dan kesahihan analisis telah dijalankan untuk mengesahkan keteguhan instrumen, persembahan grafik seperti carta bar telah dibangun, dan akhirnya Purata Min Indeks Skala telah dibuat. Hasil kajian menunjukkan bahawa, 46.7% daripada organisasi responden mendapatkan bahan binaan tanpa permintaan lokasi mengikut peruntukan jurutera tapak, manakala 28.9% daripada organisasi responden mendapatkan bahan binaan dengan permintaan lokasi mengikut peruntukan pengurus projek dan 13.3% daripada organisasi responden mendapatkan bahan binaan oleh jurutera. Hasil kajian menunjukkan bahawa pada masa ini tidak ada sistem pembinaan pengurusan bahan yang seragam dan berkomputer yang diterapkan Somalia. Penyelidik membuat kesimpulan bahawa semua syarikat kontrak berminat untuk menggunakan beberapa teknik untuk menguruskan bahan binaan seperti mencipta dan mengemaskini pangkalan data bagi kategori bahan-bahan dari pembekal tempatan dan antarabangsa. Akhir sekali, kami mengesyorkan untuk menggunakan sistem pengurusan bahan binaan berkomputer untuk mengurangkan tenaga dan masa, dan untuk mencapai hasil yang lebih tepat.

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## LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| *JIT* | - | Just-In-Time |
| *ICT* | - | Information and Communication Technologies |
| *RFID* | - | Radio Frequency Identification |
| *SCM* | - | Supply Chain Management |
| *I-MATRACS* | - | Intelligent Materials Tracking System |
| *GPS* | - | Global Positioning System |
| *UWB* | - | Ultra-Wide Bands |
| *PDA* | - | Personal Digital Assistant |
| *GPRS* | - | General Packet Radio Service |
| *LADAR* | - | Laser Distance and Ranging |
| *RTK* | - | Real-Time Kinematic |
| *a* | - | Constant Weighing Factor |
| *xi* | - | Frequency of Respondent |
| *i* | - | 1,2,3,4,5……. n |
| *m* | - | Meter |
| *Sh/S* | - | Somalian Money |
| *ASP* | - | Application service provider |
| *ERP* | - | Purchased as enterprise resource planning |
| *CAD* | - | 2D, 3D, drawings |
| *CPM* | - | Comprehensive Project Management |

# CHAPTER 1

# INTRODUCTION

## 1.1 Research Background

The construction industry is vital for the development of any nation. In many ways, the pace of the economic growth of any nation can be measured by the development of physical infrastructures, such as buildings, roads and bridges. In the construction management site, the performance of the construction practice is very essential and it has many effects, improper handling of materials during site activities and it has the potential to severely obstacle project construction performance. There are major issues, which affect materials management activities, constraints on storage areas, site logistics concerning materials handling and distribution, and also ordering and delivery of materials to the construction site. The other issue of the effect of the performance of the construction is improper storage and need large storage. Also, transportation difficulties and inappropriate materials delivery, and include manual processes, and non-compliance with specification according to (Takim, 2002).

There are numerous approaches, which was addressed materials management problem issues. There are proposed method for proper planning of materials, logistics, Just-In-Time (JIT), the method is to resolve the problems of space constraints, and the implementation of Information and Communication Technologies (ICT) such as bar-coding for automatic tracking of materials (Kasim, 2010).

## 1.2 Problem Statement

After decades of civil war and the collapse of the central government in 1991, Somalis and international supporters have renewed efforts – and made progress – since 2012 in re-establishing state structures and bringing stability to the country. Improved security in Somalia's capital, Mogadishu, has boosted the local economy. New housing estates are being built amid an economic boom as diaspora Somalis return and newly wealthy businessmen capitalise on the relative peace in Mogadishu. Many long-abandoned seafront villas are being rebuilt as part of a construction boom that has seen rents triple in recent months in the city's prime locations according to (Billow, 2014).

Given the construction business boom, Somalia do not have currently well-established construction material management system. The materials management practices in these countries are performed on a fragmented basis with unstructured communication and no clearly established responsibilities between the parties involved. This fragmentation creates gaps in information flow, which affects the decision making process and lead to delays in material ordering and receiving, among other problems (Thormas *et al.*, 1989). As far as we know there is no research effort that has been done to investigate the construction materials management practices of contracting companies in Mogadishu-Somalia. It is important to explore and evaluate these practices, and then offer recommendations and develop practical techniques to improve existing practices.

On the other hand, Current materials management practices in the contractor companies in construction industries are performed on a fragmented basis with unstructured communication and no clearly established responsibilities between the parties involved. This fragmentation creates gaps in information flow, which affects the decision making process and lead to delays in material ordering and receiving, among other problems. The material manager needs to realize that decisions taken at four stages in the process will certainly impact other activities and processes in the supply chain, logistic, storage, problems are not realized due to this fragmentation (Perdomo-Rivera *et al.,* 2004).

It is gathered that current manual materials management and control procedures are unsatisfactory as they are labour intensive, inaccurate and error prone. The implication leads to waste and surplus of materials, delays, decrease in productivity and lack of up-to-date and real-time information (Navon, 2005).

The initial phase of this research investigated current material management practices of contractor companies in construction industries. The investigation considered the entire range of activities necessary for procuring the needed material, starting with the estimating process and ending with site delivery, distribution and storage logistics. Research outcomes included documenting the problem bottlenecks in the supply chain, logistic, storage, and handling, as well as identifying and classifying the various criteria that influence the decision process for procuring material. A comprehensive flowchart describing the material management process was developed based on various discussions and considered many decision alternatives including material type, supplier availability and relationship, procurement options and incentives, quantities needed, delivery dates, storage alternatives, and project schedules (Robinson *et al.*, 2005).

Many challenges are encountered during the various phases of material management process including challenges with material procurement, material storage & distribution. Examples of challenges include: procurement challenges, Supplier selection challenges, Jobsite storage and handling challenges. The majority of the problems faced by contractor companies with respect to materials management are encountered at the job site and include tracking of material, storage issues, material distribution and re- handling. The material procurement (ordering and delivery), this phase is very critical to the successful execution and completion of any project. The person in charge of procuring materials or the purchasing department, in the case of a large company, needs to ensure that the correct materials in the correct quantities are ordered. They also need to verify the release dates at which the material is needed and clearly specify those delivery dates as well as the location of delivery to the supplier (Perdomo-Rivera *et al.*, 2004).

Material logistic problems greatly affect the construction stage and failure to manage this phase effectively could result in project disruption and possible delays due to late deliveries, stock outs due to small quantities bought, material delivered to the wrong locations, material backordered and overall costs. The owner has to systematically follow up the status of ordered material to assure that the material

arrives to the job site in the quantities and dates specified. Expediting is one control system necessary to assure a timely equipment and materials arrival to achieve a project completion on schedule. Expediting involves monitoring all steps in the procurement cycle, with special focus on those involving the vendor or subcontractor, to assure reliable, economical, on-schedule delivery (Cutting-Decelle *et al.*, 2002).

Ensuring that material deliveries occur on a timely basis is a very difficult task. As revisions come through from material take off, it is all too easy for this to impact on material deliveries, resulting in them arriving late or in insufficient quantities. The impact of schedule changes can have a similar effect. While material may originally have been ordered in good time, this may no longer be the case. Design changes may result in a reduction in requirements for some material and an increase for others, which will also affect the delivery schedule. These changes can have a considerable impact on cost and evaluating the full impact of the changes is extremely important. Material may not arrive on time, work may have to begin out of sequence, or the fabrication process may be delayed. Effective planning and communication is required to keep costs to a minimum, to minimize errors in ordering and to increase the probability that the material is on site when needed. Constant communication and clearly specifying, without ambiguities, the material needed could help to minimize errors (Thabet *et al.* 2002).

Due to the fact that the problems in materials management will be never ending, it is plausible that ICT may be the answer to overcome the challenge of materials management in the construction industry. The dilemmas faced in materials. Management can be overcome by adapting ICT-enabled solution that can help support and effective management of materials activities. In this research, defined factors affecting material management from the opinions of managing material management practice in construction site. The main contribution of this research is to support site office system. The important of site office is material delivering, material storage, material's used.

## 1.3 Research Questions

(i) What is the current practices of materials management in construction site?
(ii) What is the problem of material management practices in the construction site?
(iii) How to improve material management practices in the construction site?

## 1.4 Research Objectives

This research aims to improve material management practices in the construction site. To achieve the aim of the research, this research has the following objectives:

(i) to investigate the current practices of material management in construction site.
(ii) to identify the problem of material management practices in the construction site.
(iii) to recommend the appropriate methods for improving material management practices in the construction site

## 1.5 Scope of Research

This research will focus on improving the performance of the material management constructions site. Major challenge at Mogadishu's construction sites is poor planning and management of resources and time among site supervisors and operational managers. Quite regularly, workers are not fully engaged for hours at a time, because construction materials have not been delivered on time or because previous work has not been completed (Secil, 2014). For data collection, this research will be using questionnaire that can be help and support effective management of materials activities. also to investigate the problems, mentioned above in problem statement of this study will focus the performance of the material management constructions from ordering, delivery handling and distributing materials to the construction site Mogadishu-Somali. Our Scope is Somalia,

especially the capital city, we will concentrate on materials management in construction site as we can see in this figure.


**Figure 1.1:** Location of Somalia (Map and Satellite Image, 2008)

## 1.6 Significance of the Study

All sectors of the industry share a common ground for material management and control. Thus, the discussion presented although it is directed towards the contractor companies in construction industry could be applied to any sector. Material management activities are required throughout a construction project and in every construction project. Moreover, the success of the project is highly dependent on the successful management of the materials required. Hence, managing the materials in an effective way is very critical to all parties involved not only in the construction industry but also in other industries. The research work is expected to provide the following benefits to the industry.

(i) Improve the management of materials for the construction industry.
(ii) Provide guidelines to assist in the materials management learning process.
(iii) Standardization of the material management practices within a company.
(iv) Investigate state of the art tools and technologies that could be helpful in managing and monitoring material and control its quality.

With the development of a structure for a material management decision support system, facilitated through a knowledge management database, the following benefits are expected:

i) Minimization of the repetition of past failures.
ii) Sharing of successful experiences.
iii) Learn from other people's experiences to avoid pitfalls and to minimize the repetitions of errors
iv) Identify specific design, process, or decision that reduces or eliminates the potential for failures.
v) Availability of corrective actions for typical problems that might impact the cost of a project.

Based on the objective in studying of improving material management practices in construction site. Will be faced by site office considered and implementation of ICT in materials management, the main tools that are widely adopted by the contractors are the Microsoft Offices and handheld devices. Subsequently, planning and procurement are the materials management processes considered needing the highest investment of ICT implementation. Evidently, ICT tools that are hardly adopted in the materials management of each respondent's company.

## 1.7 Research methodology

Research methodology explains the method used in conducting the research. The steps involve are; formation of problem statement, developing research Objectives, literature review, data survey using questionnaire, data analysis, then conclusion and recommendations. This research uses quantitative approach and would be conducted in three stages, as shown in Figure 1.2. The first stage is the process to identify research issues, topic selection, problem statement and research Objectives. Second stage is the literature review to find out the previous study related to improving appropriate methods of materials management in construction projects. The third stage shows the types of data collection to be used in this research, which are literature review and questionnaire survey. The final stage discussed on data analysis process, results and findings based on the survey using questionnaire form, conclusion and recommendations for the research in order to solve the problems on materials management in construction industry.

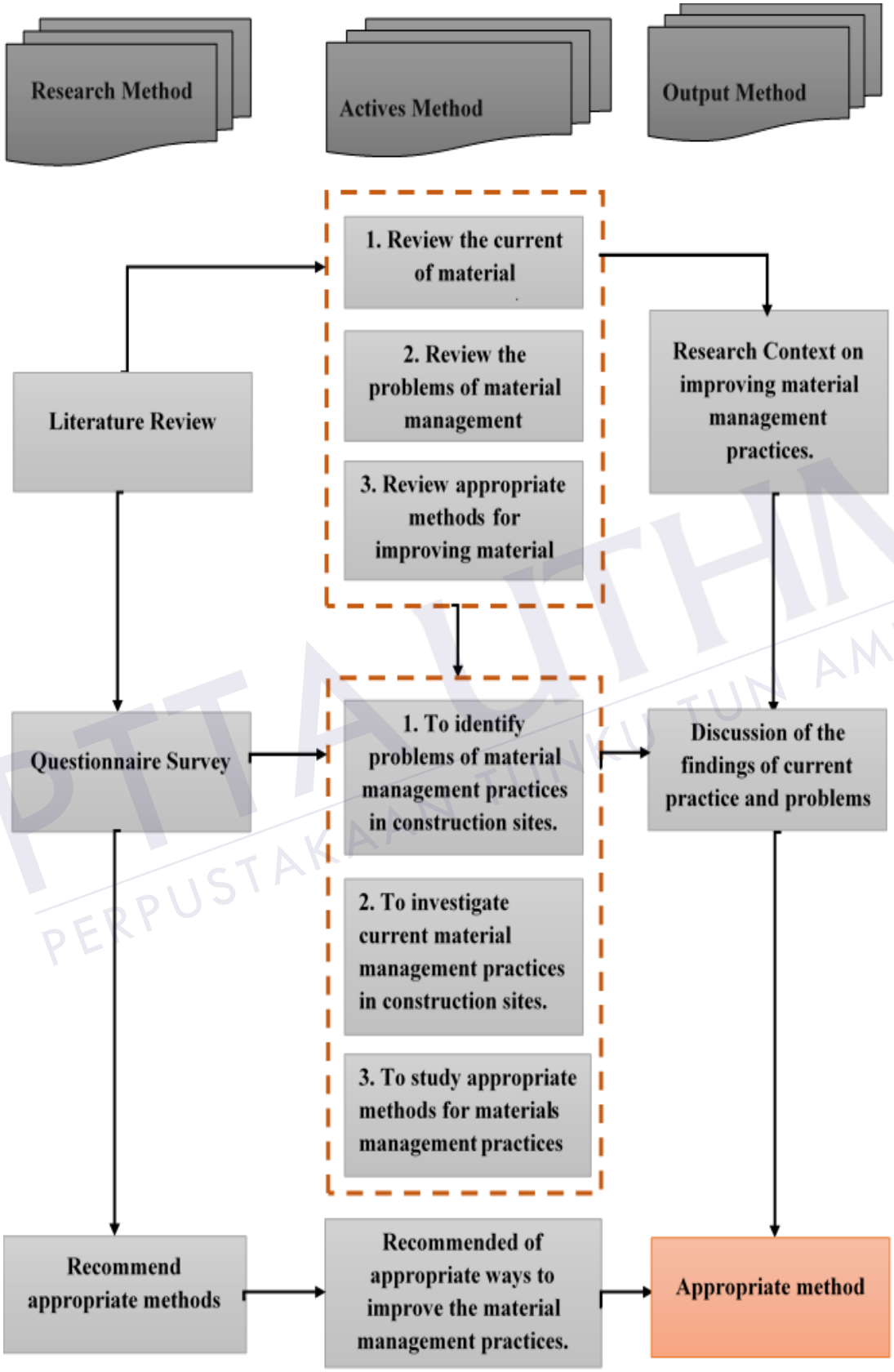


**Figure 1.2:** Flow Chart the of Research Method Activities and Output

## 1.8 Outline of Thesis

The thesis consists of five (5) main chapters. The chapter's organization are Details and explanation to every chapter will be discussed below:

**Chapter 1***: Introduction*

This section introduces the research topic. It consists of the research background, research problem, research questions, research Objectives, research scope, and research significance. Finally, the chapters' outline and summary.

**Chapter 2***: Literature review*

This chapter reviews problem of material management practices in the construction site and appropriate methods for improving materials management. The chapter also focuses on identification of the research gaps that have not been discussed by previous researchers or need to be discussed more. The chapter also focuses on general suggestions to minimize interface problems.

**Chapter 3:** *Research methodology*

This chapter discusses the research approach and strategies, and the procedures to be adopted in conducting the research. This includes, research process and design, population and sampling techniques to be used. It also discusses the instrument of data collection and data analysis technique.

**Chapter 4:** *Data analysis and discussion*

This chapter presents the data obtain from questionnaires and make analysis of the data. It also discusses the result from the survey conducted. The chapter also discusses on the findings obtained from the analysis which forms the basis of recommendations for future research.

**Chapter 5:** *Conclusion and recommendations*

The last chapter in the research summarizes the entire research work to be conducted where conclusion would be made. The recommendation is given based on the research subject matter for possible action to be taken. This chapter ends with highlighting the limitations in the research and conclusion.

## 1.9 Summary

This chapter explains the current practices of material by seeking the views of material management practices at construction site. To suggest a good method to implement material management at construction site in Mogadishu-Somalia that provides context in formulating the research approach taken to accomplish the objectives of the study. The contractors are in a strong position as they have the guidance to define the problems and to improving appropriate methods of materials management in construction projects. This aimed at enhancing materials management as a standard towards successful project productivity. In addition, the research also outlined the research scope and the methodology to be used in the research process. Therefore, further relevant information that relates to the research will be discussed in literature review in the subsequent chapter.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

Different researchers provide different definitions for material management. Therefore, different definitions can be found in different references. Material management is concerned with the planning, identification, procuring, storage, receiving and distribution of materials. The purpose of material management is to assure that the right materials are in the right place, in the right quantities when needed. The responsibility of one department (i.e. material management department) for the flow of materials from the time the materials are ordered, received, and stored until they are used is the basis of material management.

Said *et al.* (2010) suggested that the development of a new optimization model for construction logistics planning that is capable of simultaneously integrating and optimizing the critical planning decisions of material procurement and material storage on construction sites. The model utilizes genetic algorithms to minimize construction logistics costs that cover material ordering, financing, stock-out, and layout costs. The model incorporates newly developed algorithms to estimate the impact of potential material shortages on-site because of late delivery on project delays and stock-out costs. Also explained that Material procurement and storage on construction sites need to be properly planned and executed to avoid the negative impacts of material shortage or excessive material inventory on-site. There are several factors within the scope of material management and each of these factors can give rise to potential problems. The more factors are divided, the more potential problems that exist. There are many factors which contribute to poor material management in construction projects.

(Phu and Cho, 2014) Suggested that factors such as waste, transport difficulties, improper handling on site, misuse of the specifications, lack of proper work plan, inappropriate material delivery and excessive paperwork all adversely effect on material management. Factors related with material management can be mostly found in the following areas in local construction projects

(i) Planning and Scheduling
(ii) Monitoring and Controlling
(iii) Organization and Personnel
(iv) Procurement
(v) Delivery
(vi) Storage and Storage facilities
(vii) Usage and Surplus and Waste control

Construction industry such as housing, infrastructure facilities use a large quantity of materials. There is a large demand in building material due to population growth and there is a gap between demand and supply management. In this situation, researchers try to find a good solution for construction material management. Valuable management of materials signifies on area with immense potential for enhancement efficiency of work and also controlling expenses. This important for building professionals and the general public because it would not only explain but also make awareness of the extent to which inadequacies in material management that can negatively affect project performance. The study aims to help the contractors, clients, consultants and all parties involved in construction projects about the ways of improving their present techniques and methods of material management. According to (Mehr *et al.*, 2014).

Developed and evaluated an automated model for management and control of materials ordering, purchasing, and supply and use. In order to evaluate the model under real conditions, the model was implemented in a prototype system and used in ongoing construction projects. The model provides a comprehensive approach, encompassing materials purchasing aspects, their delivery to the site and their dispatching for use in the building. The model can reduce the time needed for materials management, reduce wastage caused by manually ordering the materials and ensure that materials on site on time, in the right quantity and according to specifications according to (Navon, 2002).

Finally defines Materials management is an important function in order to improve productivity in construction projects. Also materials management functions include "material requirement planning and material take off, vendor evaluation and selection, purchasing, expenditure, shipping, material receiving, warehousing and inventory, and material distribution". This is concerned with the planning and controlling process to ensure that the right quality and quantity of materials and installed equipment are appropriately specified in a timely manner, obtained at reasonable cost and are available when needed. Materials management involves the logistics of the materials component so for a supply chain which involves the process of planning, implementing and controlling of the movement and storage of raw materials, work-in-process inventory. The management of materials should be considered from the phases of the construction process and throughout the construction period. Generally, construction materials are bulky, expensive and are supplied in large amounts to construction sites according to (Kasim, 2008).

Therefore, there is a need for an excellent management system for handling materials. The person in charge of handling materials should keep in mind the goals of the company and insure that the company is not paying extra money for materials. The goal of every company is to make a profit. This is the basis for company survival, costs should not exceed income, but keeping in mind customer's expectations.

## 2.2 Materials Management in Construction Site

Materials Management has been defined as the management system for planning and controlling all necessary efforts to make certain that the right quality and quantity of materials and equipment are specified in a timely manner, are obtained at a reasonable cost and are available when needed. In the past, construction managers have been more consumed with the control of labor and the control of plant. There is now a growing awareness that materials' wastage and shortages are diluting the profit to the contractors more than other reasons. Material management functions can be generally categorized as (Dawood *et al.,* 1994).

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